REMARKS

Claim Amendments

Claim 5 is amended to refer to the bi-prism.

Claim 6 is amended to more specifically claim the construction of the bi-prism, as shown in Fig. 2.

Claim 18 is amended to make consistent use of the term "bi-prism beam splitter."

Claim 32 is a new claim that includes the limitations of Claim 6, but is dependent on Claim 18.

Claims 1, 2, 5, 7, 11, 12, 13, 15, 16 and 26 of the present application are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al. ("Nelson", U.S. Patent No. 6,750,453) in view of Griggs et al., ("Griggs", U.S. Patent No. 4,520,265). Applicants respectfully traverse this rejection.

Nelson is distinguished from Claims 1-17 by the recitation of detecting the presence of ethane by detecting variations in solar radiation reflected from the target area. Nelson provides his own light source as a source of radiation to be detected. The Examiner cites Griggs as teaching detecting solar radiation in for example Col. 2, lines 28-46, and concludes that it would be obvious to modify Nelson as taught by Griggs.

The Examiner has misunderstood Griggs. Griggs, when read as a whole, teaches away from detecting the presence of ethane by detecting variations in solar radiation reflected from the target area.

Thus, Griggs states, at Col. 1, lines 49 - 51: "It is another object of this invention to provided RGCF apparatus which is blind to reflected solar radiation" (emphasis added).

And further, at Col. 1, lines 58 to 60: "Stated succinctly, in this invention the effect of reflected sunlight is made negligible by using an extremely narrow spectral filter..."

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What Griggs teaches in Col. 2, line 28 - 46 (cited by the Examiner) is not that one should use solar radiation to aid in the sensing of gas but rather that solar radiation is one of the components in the measured signal, nothing more.

Griggs thus teaches an apparatus which eliminates unwanted solar radiation rather than making a measurement using solar radiation, the complete opposite from what is claimed.

Hence, Claims 1, 2, 5, 7, 11, 12, 13, 15, and 16 are believed patentable over Nelson in view of Griggs.

(Claim 26 is already canceled).

Claims 3 and 8 of the present application are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al. in view of Hodgkinson. Applicants respectfully traverse this rejection.

Nelson is distinguished from Claim 1, from which Claims 3 and 8 depend, by the recitation of detecting the presence of ethane by detecting variations in solar radiation reflected from the target area. Hodgkinson fails to disclose detecting variations in solar radiation reflected from the target area. This is sufficient to dispose of the rejection. In addition, the following arguments apply.

The Examiner recognizes that Nelson et al. does not disclose the claimed bandwidth of 2850-3075 cm^{-1}, but recites Hodgkinson as disclosing this bandwidth in his Fig. 2.

Although Fig. 2 shows a much wider band for ethane than is known in the Hitran database, what Hodgkinson does not show is whether this band has any fine-scale structure (absorption lines). The Hodgkinson reference shows a very low resolution scan of the C_2H_6 band at 3000 cm^{-1} with very little information as to what the figure represents or how the measurements were made. As a consequence it is almost impossible to tell whether the absorption feature represents anything new above the Hitran data, and impossible to tell whether the absorption feature contains any new absorption lines.

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For the GFCR technique to work, it requires that the gas being measured has fine-scale (spectral) line structure as disclosed in Fig. 3 of the present application. In other words, the individual absorption lines have to be distinct under typical measurement pressures and temperatures. The GFCR technique uses a sample of the gas of interest as a "spectral filter" to select wavelengths over a wide pass-band where the gas of interest absorbs. In other words, to first order, a GFCR measures the gas of interest only at wavelengths where the gas has an absorption line. This provides two distinct and very important advantages. First, by selecting only wavelengths where absorption of the gas is located, sensitivity to that gas in significantly increased. Second, by selecting only wavelengths where the gas of interest absorbs, it reduces the interference of other gases which may have absorption lines in the same spectral region. Since most of the absorption lines of the interfering gases will not overlap the lines of the gas of interest, sensitivity to interference by other gases is minimized. If a GFCR is used to detect a gas in which the absorption band does not contain any fine structure (as is shown in the Hodgkinson reference), the GFCR will have very little selectivity for the gas of interest. Any interfering gases (gases with absorption lines within the band such as water) will interfere substantially with the measurement, producing erroneous signals. For ethane, it is not immediately clear that fine-structure in the band should exist. And Hodgkinson's data does not suggest it does. All that can be said from the Hodgkinson reference is that there seems to be a larger than expected broad absorption feature in ethane at 3.35 μm from a spectral measurement of an unknown spectral resolution of an unknown quantity of ethane. This figure does little to suggest that this absorption feature might make a good spectral band for measuring C_2H_6 with a GFCR.

Consequently, it is submitted that Claims 3 and 8 are patentable over the cited references.

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Claims 4 and 9 of the present application are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al. in view of what is old or well known. Applicants respectfully traverse this rejection.

Nelson is distinguished from Claim 1, from which Claims 4 and 9 depend, by the recitation of detecting the presence of ethane by detecting variations in solar radiation reflected from the target area. In addition, the following arguments apply.

If this rejection is based on Hodgkinson, that rejection is dealt with by the argument presented above in relation to Claims 3 and 8. If the rejection is based on the allegation that "any specific band would have been an obvious design choice", that is incorrect. Various factors dealt with above in relation to the Hodgkinson reference make the selection of the band more than routine skill. A specific absorption peak of a target gas must provide adequate absorption bands, as well as not include interfering bands of other absorbers, and provide a sufficiently strong signal over background that the signal is detectable.

Claims 6, 10, 14, 18, 20, 24 and 25 of the present application are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al. in view of French. Applicants respectfully traverse this rejection. Claim 5 has been amended to include a limitation from Claim 6 and so will be treated under this rejection as well. New Claim 32, an apparatus claim including the limitations of Claim 6, will also be treated under this rejection.

The conventional Fresnel bi-prism described in French or Fateley (also cited by the Examiner) is formed of two wedges joined at their thicker sides to create an isosceles shape. A beam incident on a Fresnel bi-prism converges after passing through the bi-prism.

The presently claimed bi-prism (see Fig. 2 for an example) causes light passing through the bi-prism to diverge into two paths (as claimed in Claims 5 and 18). More specifically, as

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claimed in Claims 6 and 32, the divergent bi-prism is formed of two wedges joined at their thinner sides.

In Claims 5 and 18, the following language clearly shows that the currently claimed bi-prism is not a conventional converging bi-prism:

> Claim 5: "a bi-prism beam splitter mounted in the housing as part of the optics for directing radiation entering the window from an outside source along two divergent paths offset from each other to divide the radiation between the first optical path and the second optical path"
>
> Claim 18: "a bi-prism beam splitter mounted in the housing as part of the optics for directing radiation entering the window from an outside source along two divergent paths offset from each other through the bi-prism beam splitter to divide the radiation between the first optical path and the second optical path"

The cited bi-prisms of French and Fateley do not direct "radiation entering the window from an outside source along two divergent paths offset from each other" and do not "divide the radiation between the first optical path and the second optical path". Rather, the device of French et al does not cause the light through the prism to diverge as claimed in Claims 5 and 18, but instead causes it to converge to produce an interference pattern. The interference pattern is used for detection. Hence, the combination of the references fails to yield the invention as claimed in Claims 5, 6, 10, 14, 18, 20, 24 and 25.

In the art, it is common to use a partially reflective mirror to achieve separation of light beams. In the claimed bi-prism, light is not partitioned using a reflected component nor caused to converge, but instead is partitioned using the transmitted components of two portions of a bi-prism. As shown in Fig. 2 of the present disclosure the energy passing through the system is partitioned biaxially. Energy passing through each half of the optical chain is imaged offset from

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each other. The distance between the images is a function of the angle of the prisms. This technique minimizes polarization problems, partly due to the fact that the angles of the prism surfaces relative to the optical axis are small. Hence, Claims 5, 6, 10, 14, 18, 20, 24, 25 and 32 are patentable over the cited art.

The Examiner, in his response to the applicants' argument, also recites Fateley, U.S. Patent No. 4,750,834, to reject Claims 18 and 21. However, as with French, the recited prism of Fateley is used to generate convergent beams that interfere with each other, rather than two separate signals that follow separate paths. Hence, Fateley is irrelevant.

Claim 17 of the present application are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al. in view of Smith. Applicants respectfully traverse this rejection. Nelson is distinguished as indicated above and this is sufficient to dispose of the rejection since Smith does not disclose the missing teaching.

Claims 21-23 of the present application are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al., in view of French and Hodgkinson. Applicants respectfully traverse this rejection.

The argument provided in respect of Claim 18 applies also to distinguish French, and the argument in respect of Claims 3 and 8 distinguishes Hodgkinson.

Claim 1 of the present application is rejected under 35 U.S.C. § 102(b) as being anticipated by Zwick. Applicants respectfully traverse this rejection.

The rejection as recited by the Examiner is a little difficult to understand. The Examiner first recites 35 U.S.C. § 103, then rejects Claim 1 as being anticipated by Zwick but then indicates that Nelson has missing teaching and recites Griggs. Applicants assume that the Examiner intended an obviousness rejection. However, Griggs teaches away from the approach claimed in Claim 1 as discussed above. Claim 1 is therefore patentable.

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Claim 2 of the present application is rejected under 35 U.S.C. § 103(a) as being unpatentable over Zwick and Griggs in view of Hodgkinson. Applicants respectfully traverse this rejection for the reasons given above in relation to Claims 1 and 2. Further, Hodgkinson does not teach anything useful in terms of the bandwidth, as discussed above in relation to Claims 3 and 8. Further, Zwick teaches a completely different bandwidth and does not contemplate using variations in reflected solar radiation to detect ethane.

Respectfully submitted,

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